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Soviet Air Defense Aviation:

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A Research Paper

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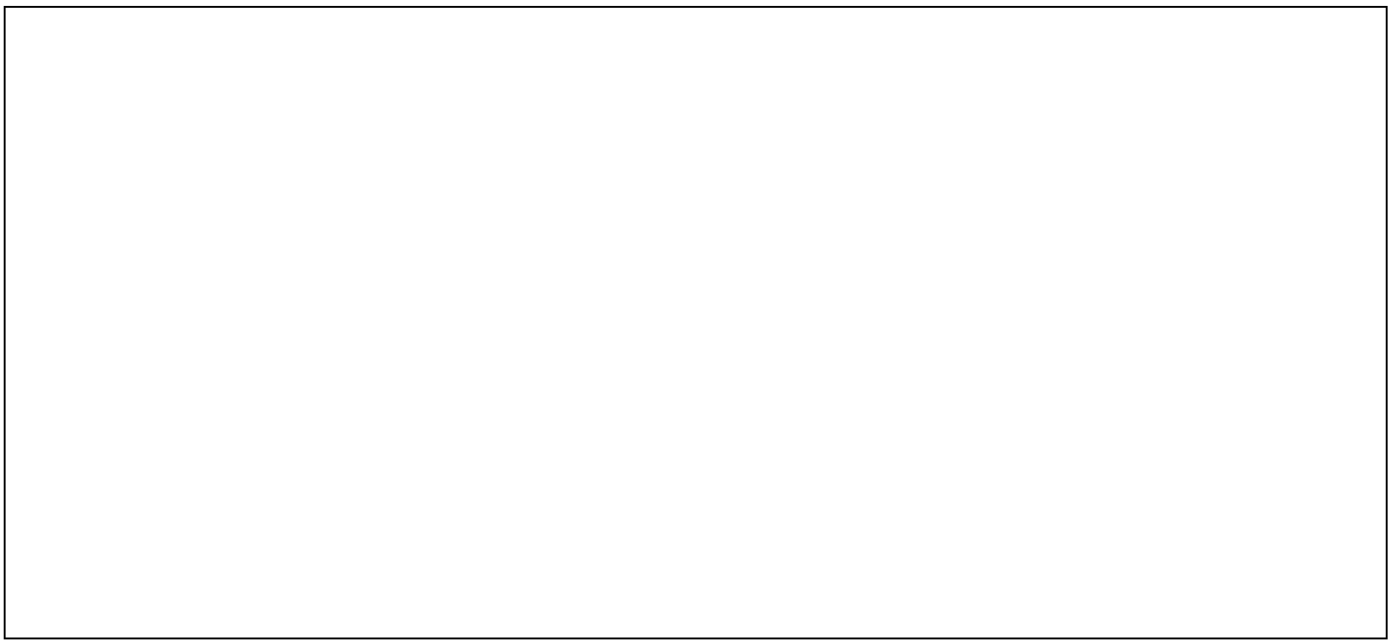

National
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Soviet Air Defense Aviation:

Training and Operations

A Research Paper
Information as of 1 January 1979 has been used in preparing the report.

Soviet Air Defense Aviation: Training and Operations

Summary

Training

Pilot training in Soviet Air Defense Aviation is conducted at three levels. Basic undergraduate flight training is conducted at two PVO higher aviation schools. Postgraduate training and ground training for pilots from units about to undergo conversion to new aircraft are conducted at Murom/Savostleyka airfield. Finally, air combat training in each type of interceptor aircraft is conducted only after pilots arrive at their assigned operational regiments.

At the higher aviation schools, students follow a four-year curriculum leading to an engineering degree and a pilot rating. All activity at the training regiments is directed toward preparing APVO pilots to intercept airborne targets. defensive maneuvers and theory are discussed in the classroom but are never practiced. Instructor pilots are required to teach strictly by the book and may not deviate from the maneuvers laid out in the training syllabus for each lesson. All training intercepts are performed under ground control.

Except for those pilots chosen to fly the most modern APVO interceptors (MIG-25 Foxbat and MIG-23 Flogger), new graduates of APVO higher aviation schools are normally assigned directly to operational regiments. They then begin the combat training course, consisting of a number of missions to familiarize them with the aircraft, the airfield and its flying zones, various navigational aids, radio commands, and radar and data-link indicators. Pilots next practice intercepts of nonmaneuvering targets. In recent years, pilots in the latter stages of the combat training course for some modern interceptors have also practiced intercepts against targets employing electronic countermeasures (ECM).

The training procedures seem unimaginative and stultifying by US standards. Despite calls by high-ranking PVO officers in the early 1970s for more realistic combat training, and especially training against very low altitude targets, APVO training in the mid-1970s remained, in general, rigid and unrealistic. Pilots are still closely wedded to ground control at all times, and there is nothing that would lead us to believe that the APVO, had made any significant gains in its ability to operate effectively against targets flying below 500 meters.

Aviatsiya Protivovozdushnoy Oborony—literally Aviation of Air Defense.

Operations

The basic administrative and combat unit in the APVO is the interceptor regiment, normally composed of a headquarters element, three interceptor squadrons, and a maintenance unit. A fully manned and equipped regiment would have 36 combat aircraft and 56 rated pilots. There are currently 80 operational regiments in the nationwide force, but few of them are fully manned and equipped.

Threat assessment and battle management are usually performed at the air defense zone command post, manned by a PVO division or corps headquarters. Some air defense zones also have intermediate control centers—called interactive control points—which are intended to speed up the passing of tracking data from a net of radar stations to surface-to-air missile (SAM) and interceptor units. Coordination between SAM and interceptor units within a zone is accomplished by area, altitude, or time separation. a commander of an interceptor regiment would be free to defend his sector autonomously only if the air defense zone command post were destroyed.

Soviet interceptors are under ground control at all times, and Soviet ground-controlled intercept (GCI) sites conduct intercepts only when both the interceptor and target aircraft remain in the field of view of the GCI site's local radars. This is not a major problem at medium or high altitude where overlapping GCI coverage is widespread, but it makes Soviet air defenses vulnerable to hostile aircraft which penetrate and remain at low altitude. The Soviets could attempt to reduce this vulnerability by remotely vectoring interceptors or conducting intercepts without ground control, but available evidence indicates that they do not currently practice these procedures.

Prospects

Since 1976, APVO has improved the equipment and training of its interceptor regiments. The decline in the size of the force has been halted, better interceptors have been added, and many existing aircraft have been modified to improve their armament. In the past two years, we have also noted instances of more realistic low-altitude training and the testing of new tactics. Serious deficiencies in low-altitude defense remain, however, and some recent incidents—in particular the penetration of Soviet airspace by a Korean airliner—have raised further questions about APVO's operational proficiency.

By the mid-1980s the Soviets can expect to face a significantly greater threat than at present from a mixed force of penetrating bombers and large numbers of long-range cruise missiles. Improved systems which the Soviets are now developing and testing could make bomber penetration considerably more difficult than it would be at present, but we doubt that these new programs would give APVO any significant capability to intercept large numbers of in-flight cruise missiles. A highly modified version of the MIG-25 Foxbat equipped with a lookdown/shootdown intercept system will enter the force in the early 1980s. It could be used with a fleet of improved airborne warning and control (AWAC) aircraft also under development to provide a low-altitude barrier over water on many penetration routes up to 1,000 km from the Soviet coast. Without an AWAC system capable of detecting low-altitude targets over land, however, the Soviets would remain vulnerable to bombers or cruise missiles which penetrated the barriers or suppressed the point defenses.

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Introduction

The aviation component of the Soviet strategic air defense forces is the largest interceptor aircraft force in the world, with over 2,600 combat aircraft assigned to operational regiments. Together with the antiaircraft missile troops and the radio-technical troops, it is responsible for defending the USSR against an air attack. This paper examines the training and operations of this interceptor force,

It provide a picture of some of the capabilities and limitations of Air Defense Aviation during the mid-1970s, and uses this data as the basis for assessing the current status of the force and its prospects into the early 1980s.

The amount of supporting evidence for this paper is uneven from one chapter to the next,

Pilot and Ground-Controlled Intercept Training

Young men desiring to become pilots in Soviet Air Defense Aviation are screened and selected by two PVO higher aviation schools. The successful candidates undergo four years of undergraduate pilot training, followed in some cases by postgraduate conversion training in new types of interceptors. They receive combat training in specific aircraft only after they arrive at their assigned operational regiments.

Prospective ground controllers in the PVO also receive four years of undergraduate training and possibly postgraduate training on the newest equipment at a separate training center. Once assigned to an operational regiment, they receive specific on-the-job combat training.

Selection Process [3]

Application to a PVO higher aviation school may be made by any healthy male high school graduate through his local draft board. Applicants are first screened and given medical examinations by city and oblast (provincial) boards, each of which has quotas for applicants to all the higher military schools. Applicants are then sent to the specific schools where final selection takes place.

PVO higher aviation schools establish high quotas to ensure that the schools have a large pool from which to select the most qualified applicants.

At the higher aviation schools, most candidates are eliminated after failing to pass stringent flight physicals and psychomotor examinations. Those who pass the flight physical are then given competitive examinations in mathematics, physics, and Russian language and literature (a procedure which almost certainly biases pilot selection in favor of ethnic Russians). After all of the tests, a commission headed by the chief or deputy chief of the school interviews the remaining applicants and decides which ones to accept.

Applicants rejected by the higher aviation schools may still become pilots by joining a DOSAAF club.[4] Graduates of DOSAAF flying schools are commissioned in the reserves. Applicants for higher aviation schools who have already received DOSAAF flight training are usually given preferential treatment. Promising applicants who cannot pass the flight physical examinations but are otherwise qualified may apply to navigator's school or become GCI controllers.

[4] DOSAAF (Voluntary Society for Cooperation with the Army, Air Force, and Navy) is somewhat analogous to ROTC, but involves all elements of Soviet society, not just university students. (U)

Undergraduate Pilot Training

At the Armavir and Stavropol' Higher Aviation Schools, students follow a four-year curriculum leading to an engineering degree and a pilot rating. Academic courses in subjects such as mathematics, physics, theoretical mechanics, and Marxism-Leninism are interspersed with basic flight training. During the first two years, students learn general flight theory and basic flying skills using L-29 or L-39 two-seat trainer aircraft. At the end of the second year, they are separated into two groups.

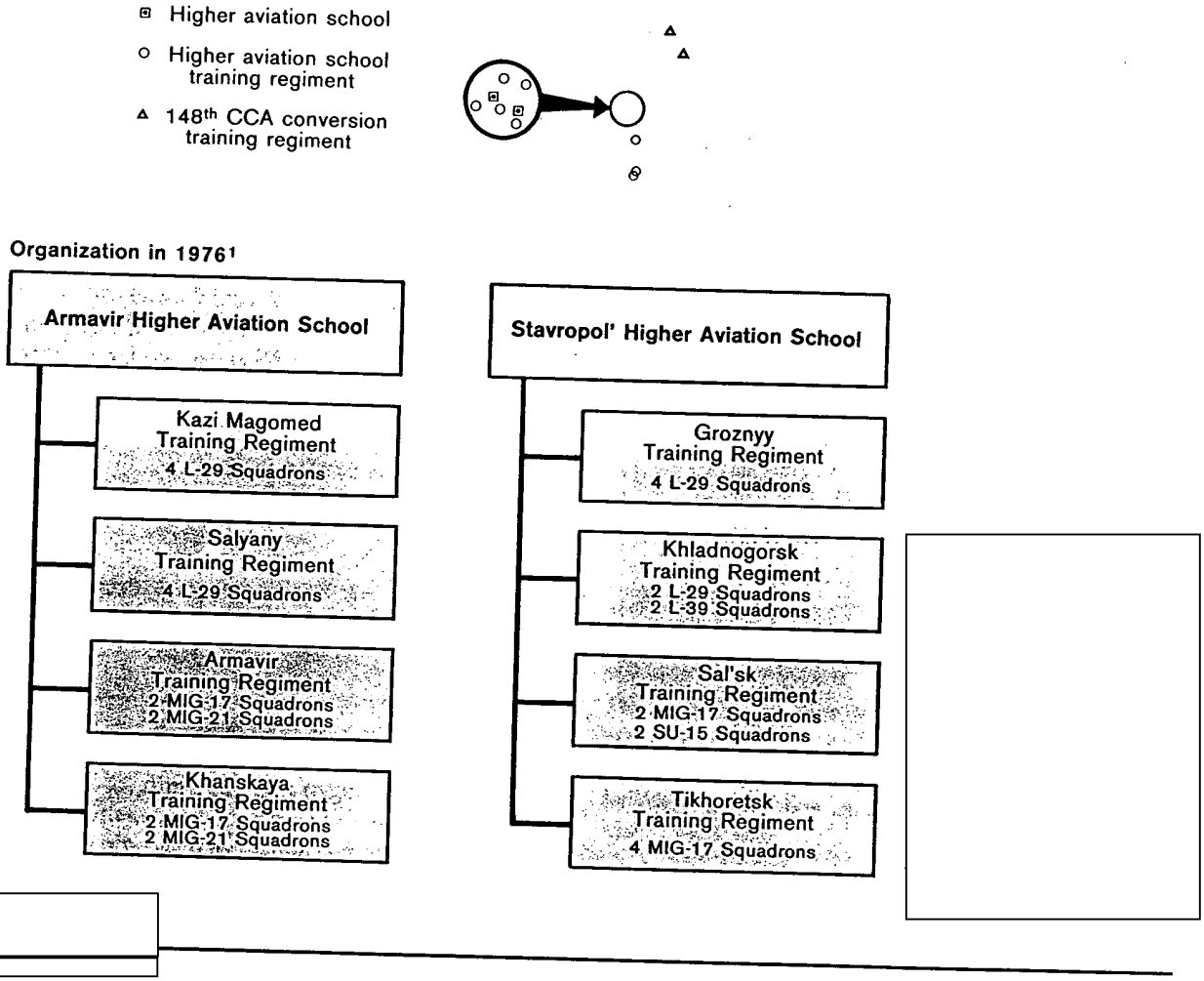
Most students fly the UMIG-15 Midget trainer and the gun-armed MIG-17 Fresco during the final two years. they learn to fly under adverse weather conditions using instrument flight rules (IFR) during the day but only in clear weather using visual flight rules (VFR) at night. After graduation, these students will usually be assigned to operational regiments equipped with APVO's older interceptors: the SU-9/11 Fishpot, the YAK-28 Firebar, and the TU-128 Fiddler.

The best students at the Stavropol' Higher Aviation School are selected to fly the SU-15 Flagon during their final two years. The SU-15, with its air intercept radar and air-to-air missiles, is a much more advanced aircraft than the MIG-17. It requires a longer transition period before students begin flying, and consequently, those trained on the SU-15 receive only day-VFR training and basic intercept training prior to graduation. Most are probably assigned directly to operational regiments equipped with the SU-15.

There are insufficient modern interceptors in the APVO training regiments for adequate undergraduate training. only the Sal'sk training regiment subordinate to the Stavropol' school had SU-15s. Two training regiments subordinate to the Armavir school, however, were equipped with some MIG-21 Fishbed aircraft. Although APVO

APVO Higher Aviation Schools and Training Regiments

Figure 1



has no MIG-21s assigned to operational units, this aircraft undoubtedly provides more adequate training for advanced students destined for regiments equipped with MIG-23s and MIG-25s than does the MIG-17, a 1950s-vintage aircraft unlike any of the modern interceptors in the force. (In 1978, the Soviets began delivery of MIG-23 Floggers to one of the two training regiments at Armavir.)

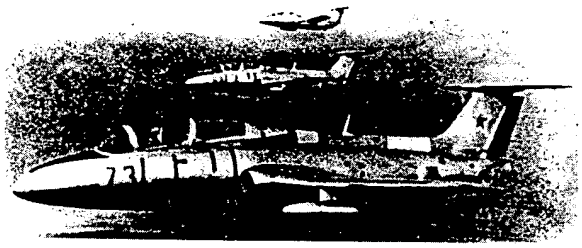
Within each training regiment there are normally four squadrons, each having 20 to 25 instructor pilots and 40 to 50 aircraft. Three to six students are assigned to each instructor. Figure 1 shows the location, organization, and equipment of the APVO higher aviation schools and their subordinate training regiments.

Aircraft in APVO Training Regiments

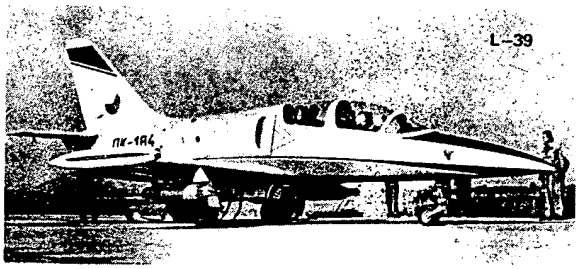
Figure 2

L-29 Maya

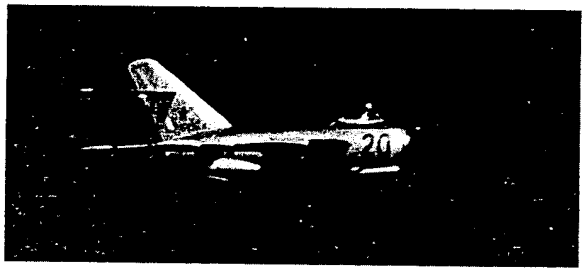
L–29



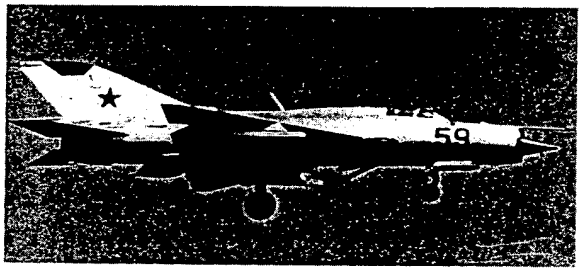
L-39 Albatross



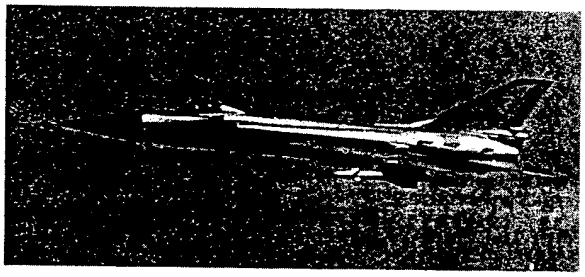
MIG-17 Fresco



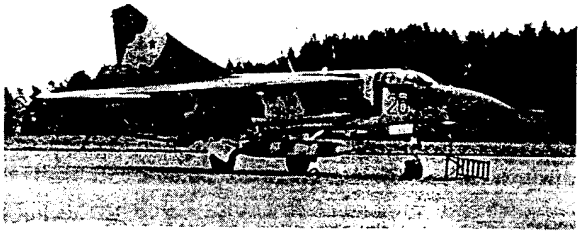
MIG-21 Fishbed



SU-15 Flagon



MIG-23 Flogger



All activity at the training regiments is directed toward preparing APVO pilots for their primary mission—intercepting airborne targets. Evasive and defensive maneuvers and theory are discussed in the classroom but are never practiced. The student is always placed in the role of attacker, and instructors are not permitted to reverse roles to illustrate, for example, the dangers of overshooting the target. Students and instructors always fly the same type of aircraft and use tactics that are briefed in advance. All training intercepts are performed under ground control, as they are in the field under operational conditions. (C)

only about 10 percent of the instructor pilots at training regiments have experience in operational units. The remainder are either recent graduates of the higher aviation schools or career instructor pilots who have never been assigned to operational regiments.

Instructor pilots are required to teach strictly by the book and may not deviate from the maneuvers laid out in the training syllabus for each lesson. After receiving their mission briefings, students are required to prepare detailed flight plans, recording every action and maneuver they will perform. They are then required to sit in the cockpit or simulator in the presence of their instructor and practice the entire mission, simulating every motion they will make during the flight. Following the actual flight, each student is debriefed and critiqued by his instructor.

Gun camera film and flight recorders are used to help grade students, but the film and tapes are processed by technicians and are not shown to either the instructor or the students. Only a grading card listing the results is given to the instructor. (S)

If a student experiences difficulty in any phase of training, the commander of his flight may require that the student fly up to six additional sorties in that phase. The decision to fail a student is made by a higher authority—presumably the squadron or regimental commander. Most students who fail to graduate withdraw from the program because of apprehension over flying or because they do not like the discipline and regimentation of military life.

The training procedures seem unimaginative and stultifying by US standards. They are, nevertheless, methodical and appear well suited to prepare the pilots for the strictly controlled flying environment they will encounter when they are assigned to an operational unit. US pilots in undergraduate pilot training (UPT) receive about the same number of flight hours in a one-year course as the Soviet pilots receive in four years of higher aviation school, but the Soviet training also includes a university-level education. (C)

Pilot Assignment and Conversion Training

Prior to final examinations, the two higher aviation schools send the records of their roughly 500 prospective graduates to the Personnel Directorate at PVO Headquarters in Moscow. the graduating pilots are permitted to request assignment to specific PVO armies (air defense districts), but the Personnel Directorate assigns people on the basis of the requirements it has received from the various units. Unless a pilot has influential contacts at headquarters, he has very little chance of receiving his choice of assignment. (C)

As noted earlier, pilots who received their training on the MIG-17 are normally assigned to operational regiments equipped with the APVO's older aircraft: the SU-9/11 Fishpot, the YAK-28 Firebar, and the TU-128 Fiddler. There is no conversion training program for these aircraft, and the new pilots fly the aircraft for the first time only after they arrive at their assigned unit.

Most pilots who received their training on the SU-15 Flagon are assigned directly to operational units equipped with that type, currently the mainstay of the interceptor force. A few SU-15 pilots, and probably most of those trained on the MIG-21, are assigned to regiments equipped with the MIG-25 Foxbat or the MIG-23 Flogger. Before flying these modern interceptors, pilots first attend a two-month ground school at the 148th Center for Combat Applications (CCA) at Murom/Savostleyka. As part of this ground training, students learn both the technical characteristics of the new aircraft and the tactics and procedures relevant to the particular base to which they will be assigned.

A flight training regiment subordinate to the 148th CCA and located at Murom/Savostleyka trains selected pilots drawn from the regimental staff and squadron leaders of operational regiments that are about to undergo conversion. New aircraft models about to be introduced into the APVO would therefore appear first at this training regiment. After returning home, these pilots instruct other pilots in their own regiments after each squadron has received its new aircraft.

A second training regiment subordinate to the 148th CCA is located at Klin airfield near Moscow. it provides flight proficiency training for instructor pilots from regiments equipped with aircraft no longer in production. Inspection teams responsible for evaluating the combat readiness of operational regiments are also located there. regiment also appears to have assumed some responsibility for training pilots from regiments that are in the process of converting to the MIG-23 Flogger.

Not all new pilots are sent to operational regiments. Some are chosen instead to become instructor pilots for the higher aviation school training regiments. did not know the criteria used to select these pilots. He The training course for instructor pilots is offered at Stavropol', and once an instructor pilot is assigned to a higher aviation school training regiment, he can expect to remain there for the balance of his military career.

Combat Training in Operational Regiments

New pilots arriving at operational regiments may be assigned as replacements to any of the regiment's three squadrons. They then begin the combat training course to qualify them in their unit's aircraft and mission. Recent graduates of higher aviation schools are not permitted to progress to the final stages of the combat training course until they have enough flying hours to qualify as pilot third class. (Table 1 shows the Soviet pilot qualification system and the requirements and limitations for each rating.)

The combat training course is unique for each type of aircraft in the APVO and may also vary from regiment to regiment depending on mission and location but its application is the responsibility of the regimental commander and his deputy for combat training. Flight commanders within each squadron act as instructor pilots. First- and second-class pilots at regiments converting to new aircraft follow the same syllabus as new and third-class pilots, but are not required to fly as many sorties in each phase.

We do not know what the normal mix of rated pilots is in APVO regiments. however, the Soviets often transfer experienced pilots into regiments about to undergo conversion from obsolescent aircraft to modern ones, and assign very few new pilots to such regiments. Thus the Soviets appear to make some effort to use the most qualified pilots to fly their latest aircraft.

Table 1

Soviet Pilot Classification System

Rating	Requirements	Restrictions
New pilot	Four years of service (includes higher aviation school) and 250-300 flying hours.	Not allowed to fly at night or under instrument flight rules (IFR). Limited to lesser missions in combat training course.[2]
Pilot third class	Five years of service and 300-350 flying hours, of which 150 hours must be in single-seat aircraft.	May not fly under IFR conditions but may fly at night under visual flight rule (VFR) conditions.
Pilot second class	Six years of service and 450 flying hours. Must be able to perform combat operations at all altitudes in formation under VFR conditions.	May not fly at night under IFR conditions.
Pilot first class	Seven years of service and 550 flying hours.	Fully qualified for day and night IFR conditions.[3]

[2] It should be noted that even though most new pilots have received some instruction in night and instrument flying, they are not permitted to fly under these conditions until they have the requisite number of flying hours for the pilot rating which would qualify them for it.

[3] All pilots are normally limited to 150 meters ceiling and 2 kilometers visibility during daylight and 200 meters ceiling and 3 kilometers visibility at night, even under IFR conditions.

During the time a regiment is in the process of converting to a new aircraft, the Soviets do not consider it combat ready, and an adjacent APVO regiment or Frontal Aviation regiment must assume responsibility for its territory. It normally takes about two years for all of the pilots of a regiment to complete the combat training course following conversion to new aircraft. In comparison, US tactical air wings are normally considered fully combat ready six to 12 months after converting to a new aircraft.

the rigidity and formal nature of preflight procedures at the higher aviation school training regiments are duplicated in operational regiments. Training flights at these regiments normally take place every other day, with the intervening days reserved for planning and preparation. On the day before each mission, pilots receive mission briefings, prepare detailed flight plans listing every maneuver to be performed, and sit in the cockpit or simulator and practice each motion, just as they had to do as undergraduate pilot trainees. On the following day, they fly the mission and are then debriefed and evaluated by their instructor pilot.

The combat training course syllabus consists of a number of missions to familiarize the pilot with the aircraft, the airfield and its flying zones, various navigational aids, radio commands, and radar and data-link indicators. Pilots then practice intercepts of nonmaneuvering targets. For aircraft armed with semiactive radar-homing missiles, this includes both front- and rear-hemisphere attacks.

n recent years pilots in the later stages of the combat training course for some modern interceptors have also practiced intercepts against targets employing electronic countermeasures. All intercepts are performed under ground control.

the concepts of free hunt, patrol, and escort (in which interceptors are assigned areas of responsibility and may attack targets of opportunity without waiting to be vectored by ground controllers) are discussed in theoretical lectures but are not practiced. The only practice intercepts without ground control were made by MIG-17 units assigned a low-altitude defense mission in the Far East. The desirability of practicing intercepts without ground control has been emphasized in

articles appearing in the open press since the mid-1960s and in some military writing on training, but with one exception, we have no evidence that such training has been carried out.

Most air-to-air missile training utilizes missiles without warheads, and some is conducted without missiles, using onboard simulators. Live air-to-air missile training is conducted at missile training facilities located near the Barents Sea, the Caspian Sea, and the Sea of Japan. At these ranges (where an entire regiment may be deployed for a week) semiactive radar-homing missiles are fired at airborne target drones. because of the expense of the drones, only the last pilot to launch a missile is allowed to destroy the drone; the others turn off their radar immediately after launch, causing their missiles to fall into the sea. The pilots also fire infrared homing missiles at flares dropped by parachute.

Gunnery training is also conducted in operational regiments equipped with aircraft that are armed with cannon. Since the drones are considered too expensive to be used as targets for the cannon, live gunnery is practiced by firing at aircraft silhouettes painted on the ground. this air-to-ground gunnery is not considered practice for strafing missions against ground targets. That role is reserved for Frontal Aviation pilots.

In both air-to-air missile training and in gunnery practice, emphasis is placed on the process leading up to firing and on the maneuver to be performed subsequent to firing, rather than on the results. The instructor pilot's paramount concern is flying safety, and as a consequence many combat maneuvers are prohibited and the pilot's combat potential is stifled. The pilot relies on the ground controller to vector him into a favorable attack position, to tell him when to shoot and where to break off, and to warn him of any aircraft attempting to attack him. The only time a pilot is permitted to fire on his own initiative is when a controller tells him that an unidentified aircraft is approaching him and the pilot identifies it as an enemy.

Pilots who have completed the combat training course are considered combat ready and may perform any mission assigned to their unit, within the weather and visibility limitations of their rating. All pilots continue to fly proficiency training missions and annually must pass a battery of examinations and flying proficiency checks. Pilots also participate in readiness exercises and in dispersal exercises in which an entire regiment, or part of it, operates from another airfield. Dispersal exercises also involve ground support personnel and may last from a few hours to several weeks.

In general, Soviet APVO pilots perform roughly the same number of sorties per year as US Air Force pilots but receive far less specific combat training. They also require considerably more time to achieve a pilot first-class rating than their US counterparts do to reach a similar level of proficiency. This is primarily because standard Soviet training sorties last only about half as long as US training flights, and US combat training tends to be more concentrated and complex.

Ground-Controlled Intercept Operator Training

Men who wish to become ground controllers in the PVO may apply to a four-year school for GCI operators located in Stavropol'. In many cases, these are men who have been rejected for pilot training because of minor medical problems. The academic curriculum at the GCI school is similar to that at the pilot training schools and leads to an engineering degree with a rating of navigator-controller. We estimate that the Stavropol' school produces about 200 to 250 controllers a year.

The practical portion of GCI operator training is conducted at Mikhaylovskaya airfield near Stavropol', where a school for flight navigators for APVO's two-seat combat aircraft (the YAK-28 Firebar and the TU-128 Fiddler) is located. The GCI student controllers utilize the flight activity of the navigator's school for basic radar training. During the summer months, the GCI course also makes use of command post facilities at operational regiments to give student controllers practical training.

graduates of the school at Stavropol' are considered the elite of the GCI force, but we are uncertain what percentage of all GCI operators have had this training.

A postgraduate course for ground controllers is taught at the 148th CCA at Murom/Savostleyka. Both graduates of the Stavropol' GCI school and former pilots and navigators being retrained as controllers attend this course, where they learn to use the PVO's most advanced data-link equipment. Once the controllers are assigned to operational regiments, their training is fully integrated with the combat training course for pilots.

Operations

Organization

The basic administrative and combat unit in the APVO is the interceptor regiment. There are currently 80 operational regiments in the nationwide force.[8] Regiments are normally composed of a headquarters element, three interceptor squadrons, and a technical unit responsible for scheduled maintenance inspections. In addition, an independent technical services battalion (OBATO) is stationed at each airfield to maintain food, fuel, and equipment supplies and to provide airfield upkeep, physical security, and other support services. (S)

Each interceptor squadron, regardless of the type of aircraft with which it is equipped, normally is authorized 12 combat aircraft, one two-seat trainer, and 16 rated pilots the regimental commander and seven of his deputies usually are rated pilots. Thus a fully manned and equipped regiment would have 36 interceptors and 56 rated interceptor pilots. A regiment may also have two to five UMIG-15 Midget utility aircraft for weather reconnaissance, one or two transport aircraft, and a few helicopters for search and recovery operations.

[8] This total includes six regiments administratively subordinate to the Baltic Military District (see page 12).

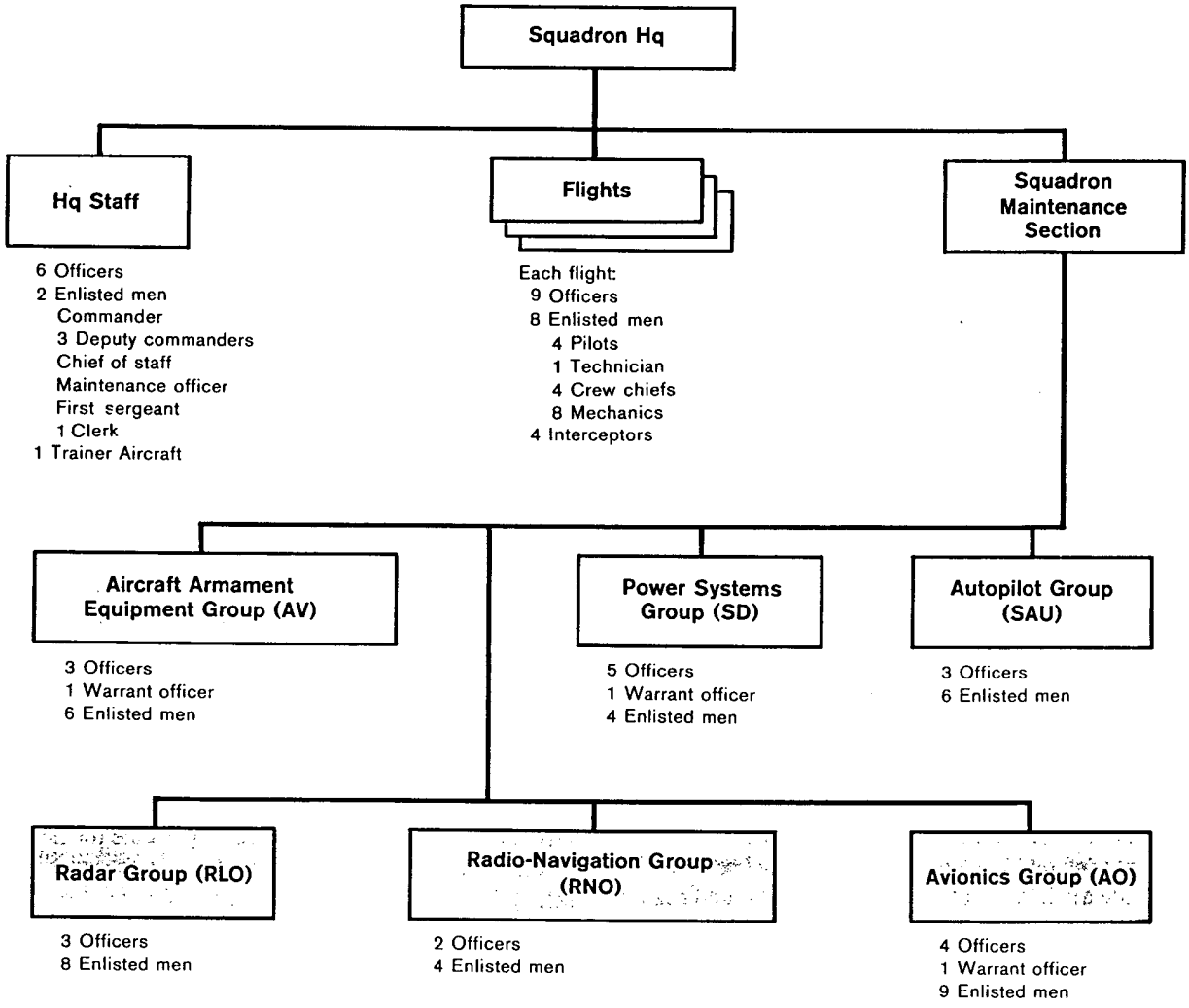
Very few regiments, however, have a full complement of aircraft at any one time, and it is doubtful that any are fully manned

Maintenance and Ground Support [9]

Each interceptor squadron has a maintenance section commanded by an engineer-officer who normally has the rank of major. the size of the squadron maintenance section depends on the type of aircraft and the number of major electronic subsystems the aircraft has. A squadron equipped with MIG-25s, for instance, would have six subsections and require two to three times as many maintenance and support personnel as a squadron equipped with MIG-17s. The squadron maintenance section performs most of the routine maintenance. (See figure 3 for the organization of a MIG-25 squadron.)

Apart from the squadron maintenance section, a crew chief and two enlisted assistants are assigned to each aircraft in a squadron. They are responsible for that aircraft only and accompany it when it undergoes its scheduled maintenance inspections. The crew chief is an engineer officer and is considered subordinate to the pilot assigned to fly his aircraft, even if the two men hold the same rank. crew chiefs are treated poorly in the APVO and have little opportunity for advancement.

Organization of an APVO MIG-25 Squadron Figure 3



Crew chiefs and their enlisted assistants are responsible for the overall flight readiness of their aircraft. Each flight (a subunit of a squadron consisting of four aircraft and their pilots) also has a technical officer who supervises the activities of the four crews in the flight. If these personnel discover malfunctions which they are not capable of repairing, the aircraft is turned over to the squadron maintenance section for repair. (

Aircraft from each APVO combat regiment normally fly every other day, although some alert and weather reconnaissance flights may be performed on intervening days. On primary flying days, the flight-line crews are required to generate four to five sorties for each of 10 to 12 aircraft over an eight-hour period. The US Tactical Air Command has found that a high number of flights in one day gives flight-line crews good practice in generating the high number of sorties which would be required during a major attack. This routine also allows sufficient time during the intervening nonflying days to perform necessary maintenance and to prepare the aircraft for the next flying day. Each APVO flight averages between 30 minutes and one hour.

The regimental technical unit is made up of engineering specialty sections paralleling the subsections of the squadron maintenance sections. It is headed by the deputy commander for aviation engineering, normally a lieutenant colonel. The technical unit is responsible for performing scheduled maintenance inspections on all of the regiment's aircraft, incuding the transports and helicopters permanently based with the regiment. it also is responsible for exercising quality control over the work of the squadron maintenance sections and for any unscheduled major repairs which can be done without sending the aircraft or some major component back to the factory. The mechanics in the engineering specialty branches also have a limited capability to repair transient aircraft, although spare parts for these craft are not stocked. (S)

maintenance inspections are required for each aircraft after every 50 flight hours. The period between major overhauls for each type of aircraft and engine varies; the MIG-25 airframe was overhauled after 250 flight hours. Major overhauls can be performed both at the factory and at a depot, and major modifications, such as the addition of 23-millimeter cannon pods to the SU-15 Flagons, are made at that time. Combat regiments are authorized to receive replacement aircraft for those sent back to the factory or depot, but such aircraft often are not available.

The independent technical services battalion stationed at each airfield is subordinate to the rear services organization of the military district in which it is located, rather than to the APVO regiment. The OBATO is responsible for the supply of fuel, food, clothing, equipment, and medical and financial services. It also has a guard company, a transportation company, and an organization responsible for runway upkeep and snow removal. the OBATO employs many civilians in various menial and janitorial tasks.

Command and Control

Each APVO combat regiment is subordinate to the deputy commander for interceptor aviation at a PVO division or corps headquarters.[10] The division or corps is responsible for defending all of the airspace within the boundaries of an air defense zone. Two or more air defense zones make up an air defense district, which is commanded by a PVO army headquarters.

Threat assessment and battle management are usually performed at an underground bunker at the air defense zone command post. Western analysts often refer to this operational element as the air defense weapons operations center (ADWOC). Soviet command post doctrine suggests that the battle staff at the ADWOC is made up of operations, intelligence, and communications officers, the corps or division commander, and the deputy commanders for antiaircraft-rocket troops, interceptor aviation, and radio-technical troops. The ADWOC receives radar tracking data and signal intelligence on airborne targets, assesses the threat, and decides how to allocate weapon systems under its control. If a decision is made to intercept the target, the chief of interceptor aviation sends an order to an interceptor regiment to launch one or more aircraft.

[10] The parent unit for interceptor, SAM, and radio-technical regiments and brigades can be either a PVO division or corps, depending on the size and importance of the air defense zone.

decisions made by a PVO corps or division headquarters may be overruled by the army headquarters or the PVO headquarters in Moscow.

Recently available evidence indicates that since January 1978 six APVO regiments have been resubordinated to the Frontal Aviation headquarters of the Baltic Military District. We do not yet know whether APVO units in other geographic areas will also be resubordinated, or whether this change represents a shift of operational as well as administrative control. In any case, we believe that these units will continue to operate primarily, if not exclusively, in their traditional role of homeland defense.

Each air defense zone is divided into air surveillance sectors in which one or more SAM or interceptor regiments may be located. Some air defense zones also have intermediate control centers—called interactive control points—to speed up the passing of radar tracking data from a net of radar sites to the SAM and interceptor units. These control points make it possible to decentralize threat assessment and weapons assignment.

coordination between SAM and interceptor units within a zone or sector is accomplished by area, altitude, or time separation. For example, a SAM regiment might be assigned to defend the airspace in one portion of a sector, and an interceptor regiment might be assigned to defend an adjacent portion. Alternatively, a SAM regiment and an interceptor regiment might both be responsible for the same sector, but be assigned different altitude belts or different times of the day. When SAMs are responsible for a given sector, protective corridors for transiting aircraft are designated. (See figure 4 for an example of fighter protective corridors in the Severomorsk Air Defense Zone.) All of these methods of interceptor and SAM coordination have been confirmed by other sources.

each interceptor regiment has an underground command post at which the regimental commander and staff are located during combat operations. Hardened command posts have been identified at many, although not all, regiments. The battle staff area of the regimental command post contains a large plexiglass board on which aircraft positions are plotted by hand. The area covered on this board is much greater than the regiment's sector of responsibility.

the regimental commander may order alerts and increase the readiness of his aircraft and crews, but he is not permitted to launch armed interceptors without permission from the deputy for interceptor aviation at the corps or division headquarters. Only if the corps or division command post were destroyed would he be free to defend his sector of responsibility autonomously.

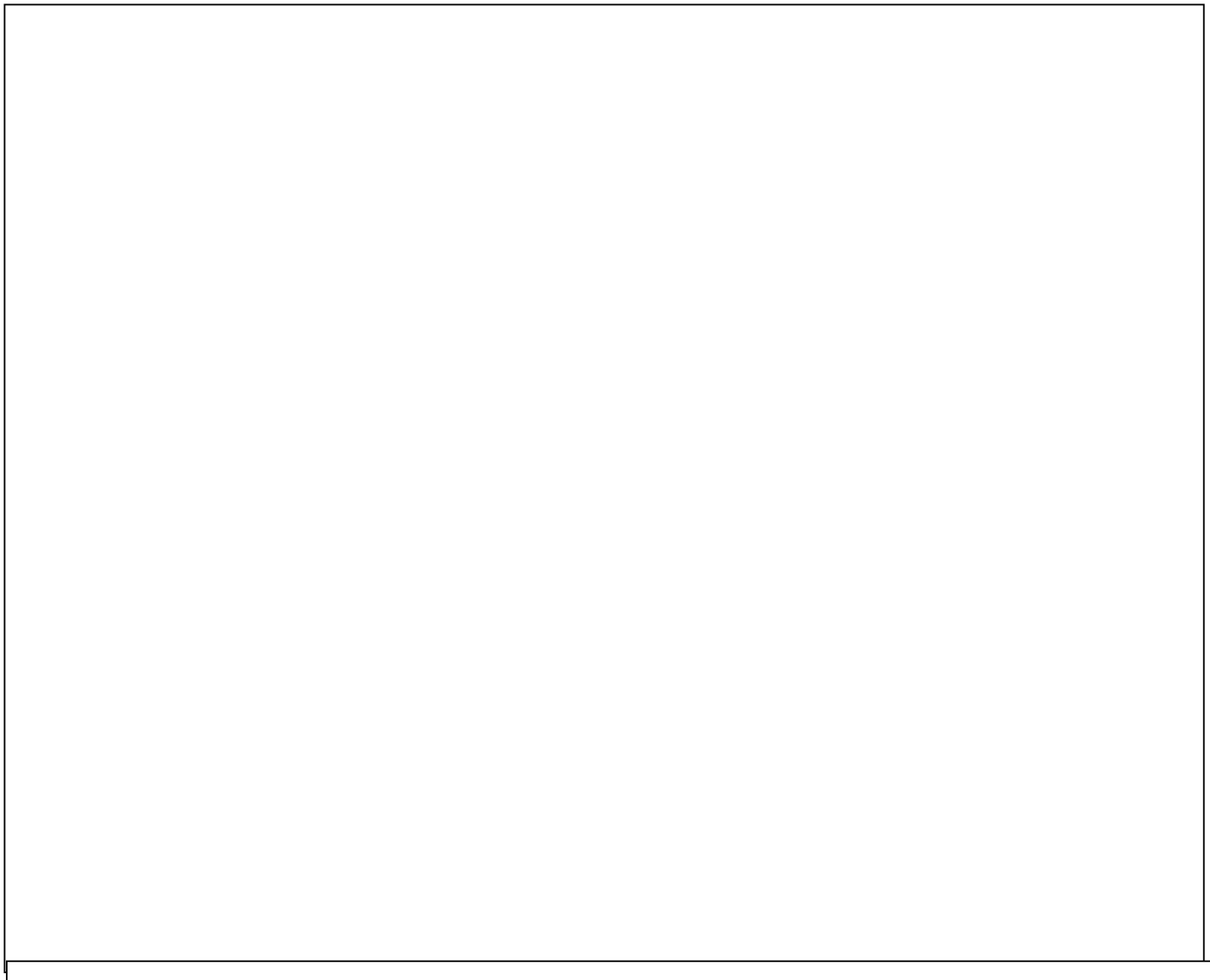
Ground-Controlled Intercept Operations

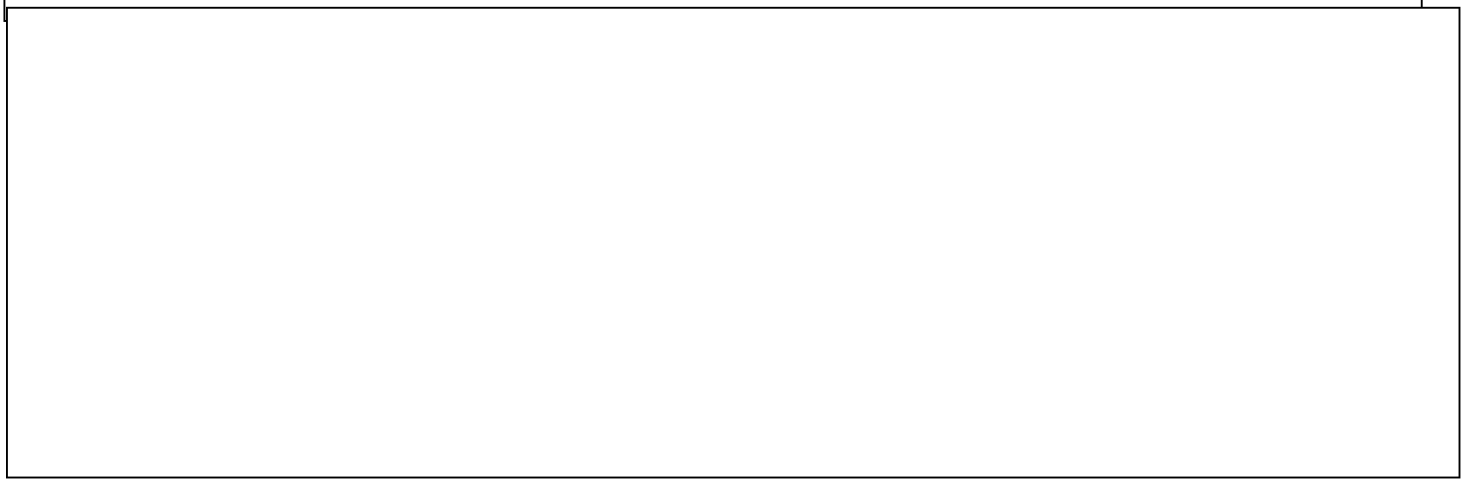
ground-controlled intercept sites are located at each regimental command post and at one or more other locations in each air defense zone. (Western signal intelligence analysts call these GCI sites fighter direction posts.) Ground controllers observe aircraft on radar scopes and direct them either by voice commands or by automatic data link.

The data link, of which there are three known variants, involves a complex semiautomated system which receives and displays target and interceptor locations and flight parameters from local radars, solves the intercept equations, and codes and transmits instructions to a console located in the aircraft cockpit.[11] the ground controller directing the intercept uses a control stick to remotely control the movements of the interceptor and vector it to a favorable attack position.

Soviet GCI sites currently conduct intercepts only when both the interceptor and target aircraft remain in the field of view of the GCI site's local radars. If either the target or the interceptor passes out of range or is masked by terrain, control of the intercept must be handed off to another GCI site. This does not present major problems at medium to high altitudes, where overlapping coverage is widespread, but it is a severe

[11] The data link is known to the Soviets as *Lazur* but is called Markham by Western intelligence





limitation at low altitudes, where the line of sight is much shorter. The data link is also unreliable at low line-of-sight angles, and voice control must be used when attempting low-altitude intercepts. (See table 2 and figure 5 for the limits of Soviet low-altitude GCI coverage.)

It is currently possible for aircraft to fly through gaps in the GCI coverage by remaining below 200 meters. Even when they are in range of the GCI site, aircraft at these low altitudes would remain in view for only a few minutes. With so little available time, controllers would rarely be able to direct a successful intercept before the target passed from their view. The Soviets could attempt to fill these gaps in their low-altitude GCI coverage by prepositioning interceptors and letting them engage targets without ground control. Over the years high-ranking Soviet military leaders have called for significantly reducing dependence on strict ground control as a continuing training objective, but evidence indicates that the Soviets almost never practice intercepts without such control. (It should be noted that, because they lack a lookdown/shootdown capability, current Soviet interceptors would have to rely solely on visual aquisition of low-flying targets if they operated without ground control.)

Table 2

Theoretical Range and Altitude Limits of Soviet GCI Radar [1]

Altitude (Meters)	Range to Target (Kilometers)
100	40
200	50
300	65
500	80
1,000	100
3,000	140
5,000	190
10,000	280
15,000	300
20,000	350

[1] These data are presented as limits for the best radar equipment performance under optimum conditions against a medium-size target. No definition of a medium-size target (in terms of radar cross section) is given. These data do not take into account the effects of terrain masking, which would further limit that line of sight.

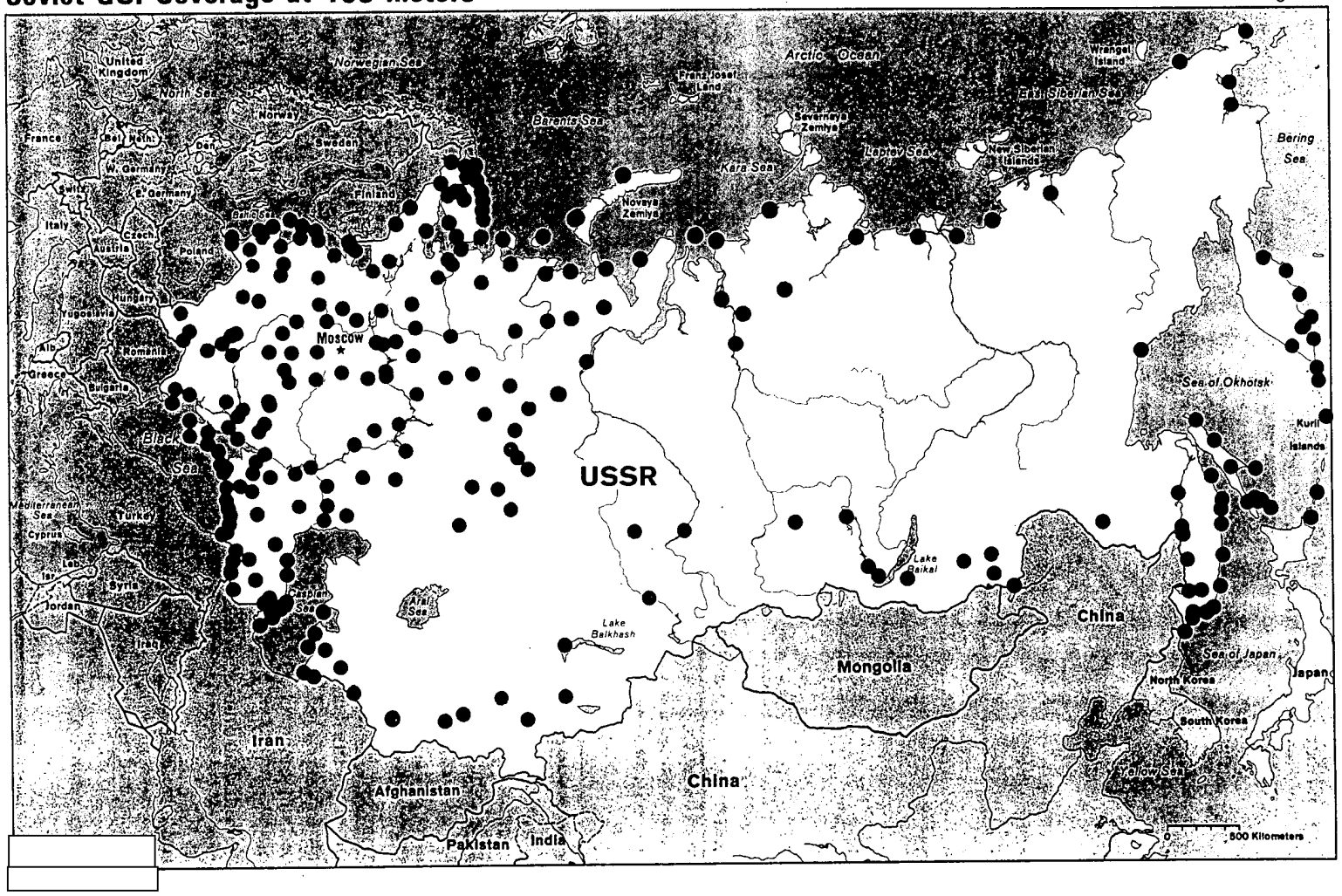
Another means of increasing the probability of intercepting low-altitude targets would be the internetting of radar stations in real time to permit remote vectoring. The Soviets already provide target tracking data from their early warning radar network to some GCI controllers through the use of semiautomated and automated data systems. If these data were available to controllers in real time, they would permit the GCI controller to vector interceptors to targets beyond the range of local radars. The data systems currently employed by the Soviets, however, do not appear to provide data that are accurate or timely enough to permit remote vectoring.

The Soviets can currently provide a limited extension of their GCI coverage beyond their borders over water by the use of shipborne controllers and TU-126 Moss airborne warning and control aircraft. shipborne controllers are under the direction of the Soviet Navy, but operate like land-based GCI sites. indicates that shipborne controllers also may employ data links to direct interceptors. issued an order in 1976 stating that interceptor direction from 200 kilometers offshore and beyond is under the control of the Navy.

The Soviets have a squadron of TU-126 Moss airborne warning and control aircraft based at Siauliai in the Minsk Air Defense District. These aircraft are used mostly to extend early warning radar coverage over the Barents and Baltic Seas as much as 1,000 kilometers from the Soviet coast. They also have occasionally been used to vector TU-128 Fiddler and YAK-28 Firebar interceptors against targets at medium to high altitudes. However, the total of nine Moss aircraft—only seven of which may now be operational—is small relative to the area that must be defended. Moreover, the inability of the Moss's radar to track targets flying below it severely limits the effectiveness of the present Soviet airborne warning and control system against low-altitude penetration over water.

Soviet GCI Coverage at 100 meters

Figure 5

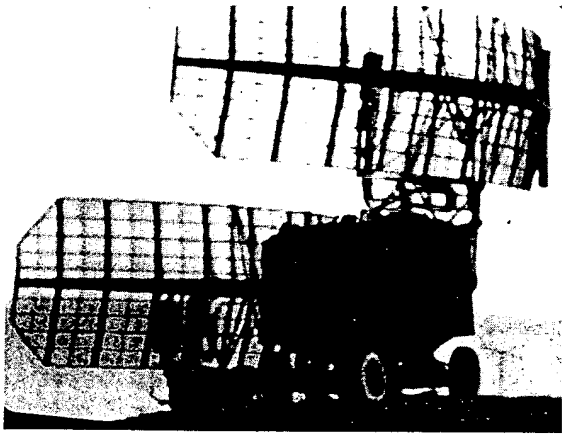


Top Secret

Top Secret

Figure 6

P-35 Bar Lock GCI Radar Figure 7



Readiness and Alert Procedures

APVO combat regiments have the same readiness conditions as the rest of the Soviet armed forces. At constant combat readiness—the normal day-to-day condition—APVO regiments normally keep two or four aircraft armed and fueled on strip alert. [redacted] units stationed near the border would have the highest percentage of personnel on duty and four ready aircraft. The rest of the regiment's aircraft would normally be parked and unarmed or would be flying training missions. [redacted]

At increased combat readiness, [redacted] all personnel not on leave would be required to report to their garrison with their individual combat equipment. Training flight activity would probably be curtailed, and the number of ready aircraft would normally be doubled. [redacted]

If a unit were ordered to full combat readiness, all duty personnel would report to their combat stations, personnel on leave would be recalled, and families would be evacuated. All of the regiment's aircraft—except for those unflyable because of maintenance problems—would be armed as swiftly as possible. Pilots would prepare for flight operations and report to the alert facility ready to fly and await orders. It normally requires one to four hours to bring an entire regiment to full combat readiness, unless the regiment must first deploy to a dispersal airfield. If dispersal is required, a regiment could require six to 24 hours to attain full combat readiness. [redacted]

In addition to the three force readiness conditions described above, there are numerical readiness conditions for individual aircraft. [redacted] an aircraft in readiness condition one is fully armed and fueled and has a pilot in the cockpit monitoring the radio. Aircraft in this condition are required to be able to be airborne within three to eight minutes, depending on the type of aircraft. [redacted]

Readiness condition two refers to a fully armed and fueled aircraft with the pilot standing by in the alert facility. Aircraft in this condition are required to be able to be airborne in six to 12 minutes. The two to four aircraft routinely on strip alert are maintained at readiness condition two. [redacted]

Readiness condition three [redacted] refers to an aircraft fully fueled and with armament ready to be loaded. The pilot would be on duty at the airfield, but not necessarily at the alert facility. Aircraft in this condition could probably be launched in about 15 minutes. [redacted]

[redacted] those pilots selected to stand alert during normal day-to-day operations are chosen from among the first- and second-class pilots of the three interceptor squadrons. Third-class and new pilots do not perform alert duty unless full combat readiness is declared. If an APVO regiment is declared not combat ready for some reason, such as having a runway under repair or having been reequipped with new aircraft, none of its aircraft are maintained on strip alert, and an adjacent APVO or Frontal Aviation regiment assumes responsibility for its sector. [redacted]

Aircraft on strip alert during peacetime are occasionally launched in reaction to reconnaissance flights by foreign aircraft near Soviet borders, or to investigate unidentified aircraft which stray into an air defense zone. [redacted] the zone headquarters will order an interceptor launched, weather permitting, any time an unidentified aircraft crosses a line 100 kilometers from the Soviet border (over water). If the intruder penetrates Soviet airspace,[12] the interceptor will force it to land at a Soviet airfield, or, if the intruder is clearly identified as a foreign military aircraft, the interceptor may be ordered to destroy it without warning. Interceptors reacting to such intruders are under ground control at all times and are never permitted to fire without permission of at least a regimental commander. During the penetration of Soviet airspace by a Korean airliner in April 1978, Soviet interceptors were not scrambled when the aircraft crossed the 100-kilometer line because initially the airliner was apparently misidentified. Otherwise, however, the procedure [redacted] appeared to be followed. [redacted]

[12] Under international law, this would extend 12 nautical miles from the coast over water. [redacted], reported the intercept line to be 25 kilometers (13.5 nautical miles) from the coast. [redacted]

Force Status and Prospects

The Force in 1976

evaluating Soviet interceptor pilot training in 1971 concluded that, while the training was probably adequate at medium and high altitudes, it was seriously deficient at low altitudes, where US bombers were intended to fly. The report also concluded that Soviet intercept procedures were too rigidly dependent on close ground control which could be disrupted by electronic countermeasures and nuclear effects. It cited articles by Soviet military writers published in the late 1960s which recognized these problems and urged improvements in training to overcome them. The report noted that despite an expansion of the APVO training establishment and the introduction of modern aircraft into the force, no discernible progress had been noted in improving low-altitude training or lessening the dependence on close ground control.

has given us an opportunity to update that evaluation. It indicates that in 1976 the force was less capable than we had judged it to be in 1971 and in subsequent estimates. It appears that no significant improvements in training were made in the five years between 1971 and 1976 and that APVO training remained, in general, rigid and unrealistic. Pilots were still closely directed by ground control at all times, and there is nothing in the information that would lead us to believe that the APVO, had made any significant gains in its ability to operate effectively at altitudes below 500 meters.

In the late 1960s and early 1970s, high-ranking APVO officers described accomplishments in Soviet aviation training and urged further improvements, especially in complicated phases of training. One general stated:

> *Primary attention must be given to the creation of a complex air situation during training, particularly during development of tactical assignments and exercises, corresponding to the believed nature of operations of the probable enemy and the capabilities of his military equipment.*

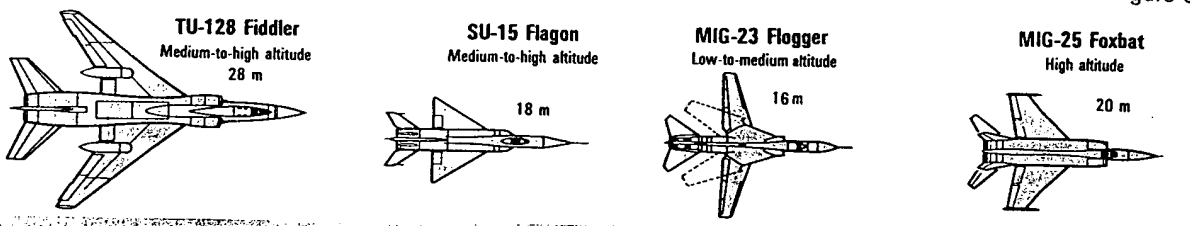
Another general, then the commander of the Leningrad Air Defense District, warned against oversimplification and lack of imagination in aviation training and demanded that exercise situations be created to make impossible the use of previously known solutions. He further urged that problems called for in the combat training courses "be performed with maximum stress: with operations at low and extremely low altitudes, with radio interference. . . ."

however, these goals were not achieved in APVO training and, in fact, the training methods employed had the opposite effect. Undergraduate pilot training was so concerned with teaching students to follow the prescribed form that pilots were conditioned not to take any initiative. Exercises were simple and predictable, and tactics were seen as the responsibility of the controller and not the pilot. If, for example, flight recorder data would show that a pilot had made an unauthorized maneuver or had failed to follow the instructions of a controller, he would receive a reprimand.

At the operational regiments, the formal nature of the student-instructor pilot relationship was continued, and this reinforced the rigidity of the combat training course. A talented flight commander who had a good relationship with the junior pilots under his command might be very effective in teaching combat proficiency. however, too many instructor pilots were only interested in preventing accidents and indoctrinating students with the school solution. In his view, even though the combat training course covered many subject areas, pilots did not receive sufficient training in complicated phases of flying such as flying in formation, intercepts while maintaining radio silence, and intercepts during bad weather.

Modern Soviet Interceptors

Figure 8



	TU-128 Fiddler	SU-15 Flagon	MIG-23 Flogger	MIG-25 Foxbat
Speed	950 kn	1,320 kn	1,350 kn	1,600 kn
Radius with combat	810 nm	375 nm	515 nm	450 nm
Armament	4 AAMs	2 or 4 AAMs plus cannon	4 AAMs plus cannon	4 AAMs
Year operational	1966	1967	1970	1970

As for low-altitude training pilots were required to practice one intercept at low altitude—defined as 500 meters by the Soviets—every six months. US plans, however, call for bombers to penetrate Soviet defenses at 100 meters and below. Since none of the current Soviet interceptors except the MIG-23 Flogger have radars capable of tracking targets flying below the interceptor in even limited ground clutter, APVO pilots would either have to depend on ground controllers to find targets and vector them within visual contact range, or fly much lower so that their radars could look up at the target. GCI coverage is severely limited at low altitudes, however, and proficient flying at altitudes below about 300 meters requires extensive practice, especially in single-seat interceptors where the pilot must operate the weapons control system and fly the aircraft simultaneously.

all other evidence indicate, however, that only a small portion of training missions are flown below 1,000 meters, and the number flown below 300 meters is negligible. It would appear, therefore, that at least through the mid-1970s, the APVO has placed virtually no emphasis on training in the combat regime posing the most significant threat.

Improvements Since 1976

Since 1976, the APVO has made progress in improving the equipment and training of its interceptor regiments. The decline in the size of the force has been halted, better interceptors have been added, and many aircraft have been modified to improve their armament. In the past two years, we have also noted instances of more realistic low-altitude training and the testing of new tactics. Serious deficiencies remain in Soviet low-altitude capabilities, however, and some recent incidents have raised further questions about APVO's operational proficiency.

Since mid-1976, the APVO has received more than 400 MIG-23 Flogger B interceptors as replacements for the obsolescent MIG-19 and SU-9 aircraft. The Flogger has good speed, range, and armament compared with other Soviet interceptors. Its air-intercept radar is the only one on a currently deployed Soviet aircraft that has even a limited capability to track targets obscured by clutter. The addition of large numbers of Floggers to the APVO has increased the force's flexibility and given it a limited low-altitude capability.

In the past several years, the Soviets have also taken steps to improve the capabilities of the aircraft already in the inventory. Cannon pods and additional rails for mounting AA-8 short-range infrared-homing missiles have been installed on many SU-15 Flagon aircraft. These not only increase the Flagon's standard armament of two AA-3 air-to-air missiles, but give it a greater capability to engage target aircraft employing ECM.

There is evidence that in the past two years some APVO regiments have been receiving training in close air-to-air combat against maneuvering targets. Even though close combat is not a normal APVO mission, interceptors in peripheral areas might be faced with attacks by forward-based aircraft and tactical strike aircraft from carriers. The introduction of the MIG-23, with its mixture of medium- and short-range missiles, cannon, and internal ECM, has finally given the APVO an aircraft with good dogfight capabilities.

Prior to delivery of the Flogger, the amount of APVO training conducted at 1,000 meters and below was very small. In a survey of selected APVO regiments' training during 1976, for example, Foxbat regiments conducted about 5 percent of their practice intercepts at 1,000 meters or less and Flagon regiments conducted less than 1 percent at these altitudes. Nearly all of these practice intercepts were conducted at 1,000 meters rather than at lower altitudes.[14]

Since most of the APVO regiments equipped with Floggers are not yet fully operational, we have little information on their training, but about 16 percent of the practice intercepts conducted by Frontal Aviation counter-air units equipped with the Flogger B in 1976 were at 1,000 meters or less.

of this type probably will become prevalent in the APVO as Flogger regiments reach the advanced stages of the combat training course.

The Flogger, however, is not the answer to the Soviets' low-altitude deficiencies because the lookdown capability of its radar is very limited. Flogger pilots have been able to achieve radar lockons from above and behind the target only at ranges of about 10 kilometers. Because of this short engagement range, Flogger pilots remain dependent on precise guidance from the GCI system to find targets and vector the interceptor to a favorable attack position.

Recent Incidents

Two recent incidents have raised questions about APVO's current operational proficiency. In April 1978, a Korean civil airliner strayed deep into Soviet airspace over the Kola Peninsula, one of the most sensitive military areas of the Soviet periphery, and one in which the most modern air surveillance and control equipment is located. During this incident, Soviet air defense forces performed their mission poorly. They reacted slowly, intercepted and identified the intruder late, mistakenly reported that they had shot down the aircraft, and lost contact with it for nearly an hour after the attack. Only a few weeks later an American light aircraft flying from Japan to Alaska violated Soviet airspace near the Kuril Islands. Four APVO MIG-17s failed to force the intruder to land at a Soviet airbase, and one of them crashed while returning to base.

The significance of these incidents should not be overdrawn in evaluating the capability of Soviet air defenses to perform their wartime mission. In both cases, the Soviets detected the border violators and brought weapons to bear on them. These incidents do illustrate, however, that APVO's actual performance in combat may fall short of the potential effectiveness that we have attributed to the force.

Prospects

By the mid-1980s, the Soviets can expect to face a significantly greater threat than at present from a mixed force of penetrating bombers and long-range

cruise missiles. These systems, particularly large numbers of low-altitude cruise missiles, will seriously burden the Soviets' ground-based air defenses, and it will be necessary for APVO to assume a greater role in low-altitude defense. Improved systems which the Soviets are now developing and testing for APVO could, by the mid-1980s, make low-altitude bomber penetration considerably more difficult than it would be at present. We doubt, however, that these new programs would give APVO any significant capability to intercept large numbers of in-flight cruise missiles.

Since September 1975 the Soviets have been testing a new interceptor, a highly modified version of the MIG-25 Foxbat, which could be ready for deployment by 1980 or 1981. This aircraft will have a two-man crew, a long-range lookdown/shootdown air intercept radar with a capability to track multiple targets simultaneously, and improved engines providing a significantly greater combat radius. [redacted] it also has cannon armament and redesigned air intakes to permit operation from unimproved runways.

The modified Foxbat could pose a substantial threat to bombers attempting to penetrate at low altitudes. In the early 1980s, modified Foxbats will replace the YAK-28 Firebar and the TU-128 Fiddler aircraft based primarily on the Soviet maritime periphery. Operated with a fleet of improved overwater AWAC aircraft, they could provide a low-altitude barrier on many penetration routes up to 1,000 kilometers from the Soviet coast. However, other factors, such as defense suppression, ECM, and operational difficulties the Soviets might have in integrating interceptor and AWAC operations, could considerably degrade these defenses.

Further improvements in APVO low-altitude defense capabilities will be dependent on progress the Soviets make in internetting ground-based GCI and early warning radar sites, training their pilots to operate at low altitudes without ground control, and developing an AWAC system with an overland lookdown capability. Without these improvements, APVO in the mid-1980s may be capable of establishing low-altitude barriers and point defenses, but would remain vulnerable to bombers or cruise missiles which managed to penetrate the barriers or suppress the point defenses. For effective area coverage, APVO interceptors must be capable of attacking airborne penetrators en route to their targets.

The Soviets have been internetting early warning radar sites and passing the airborne tracking data to GCI sites since at least the early 1970s, but we have yet to detect any indication of remote vectoring of interceptors. Soviet air defense officers have also been writing in [redacted] military publications since the late 1960s about the necessity of practicing low-altitude intercepts without ground control. [redacted] Finally, while there is strong evidence of a Soviet program to deploy a new AWAC system based on the IL-76 airframe, we have no evidence of its capabilities to detect and track low-flying airborne targets over land. We doubt that the Soviets could deploy a system comparable to the USAF AWAC system—the E-3A—before the mid- to late 1980s.

[redacted]